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Abstract for an Invited Paper
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Volume-wise destruction of the antiferromagnetic Mott insulating state through quantum tuning.[1]

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$RENiO_3$ (RE = rare-earth element) and V_2O_3 are archetypal Mott insulator systems. When tuned by chemical substitution ($RENiO_3$) or hydrostatic pressure (V_2O_3), they exhibit a quantum phase transition (QPT) between an antiferromagnetic Mott insulating state and a paramagnetic metallic state. We demonstrate through muon spin relaxation/rotation (μSR) experiments that the QPT in $RENiO_3$ and V_2O_3 is ?rst order: the magnetically ordered volume fraction decreases to zero at the QPT, resulting in a broad region of intrinsic phase separation, while the ordered magnetic moment retains its full value until it is suddenly destroyed at the QPT. [1] These two cases correspond to the band-width tuning of Mott transitions, and also associated with structural phase transitions, Volume evolutions of antiferromagnetic transition from μSR will be compared to those of structure by x-ray and metallicity by nano optics, in first-order thermal Mott transition in a V_2O_3 film at ambient pressure. These results will be compared to the process of destruction of magnetic order in another Mott transition system Ba(Co,Ni)S_2 in "filling control" without structural transition, and in parent compounds of high-Tc cuprates and Fe-based superconductors. We will also discuss roles of first-order quantum transition in generating soft modes relevant to magnetic resonance mode in unconventional superconductors [2]. Work performed in collaboration with the groups of: J.A. Alonso (Madrid), H. Kageyama (Kyoto). E. Morenzoni (PSI), G.M. Luke (McMaster), C.Q. Jin (IOP Beijing), F.L. Ning (Zhejian), S.J.L. Billinge (Columbia), S. Shamoto, W. Higemoto (JAEA), A. Fujimori (Tokyo), A. Gauzzi (Paris), R. de Renzi (Parma), G. Kotliar (Rutgers), M. Imada (Tokyo), D. Basov (UCSD), I, Schuller (UCSD). [1] B.A. Frandsen et al., Nature Communications 7 (2016) 12519. [2] Y.J. Uemura, Nature Materials 8 (2009) 253-255.

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